CLAIMS

What is claimed is:

1.   An encoding apparatus for embedding data in a compressed data stream, the apparatus comprising:

a partial decoder receptive of the compressed data stream and operable to partially decode the compressed data stream, thereby obtaining a partially decoded data stream having quantization indices;

a data embedder in communication with said partial decoder and receptive of the data and the partially decoded data stream, said data embedder operable to embed the data into the quantization indices, thereby obtaining a data-embedded partially decoded data stream; and

a partial encoder in communication with said data embedder, said partial encoder operable to partially encode the data-embedded partially decoded data stream, thereby obtaining a data-embedded compressed data stream.

2.   The apparatus of claim 1 further comprising an index selector in communication with said partial decoder, said index selector operable to select a plurality of the quantization indices, thereby obtaining selected indices, and to determine respective amounts by which to modify the selected indices,

wherein said data embedder is operable to embed the data into the quantization indices by modifying the selected indices according to the respective amounts, thereby obtaining a data-embedded partially decoded data stream.

3.   The apparatus of claim 2, wherein said index selector is operable to:

choose indices corresponding to ranges within a sensitive portion of a human sensory range;

discard zero indices; and

always determine a minimum amount.

4.   The apparatus of claim 1, wherein said data embedder is receptive of an encoding key and operable to embed the data based on the encoding key.

5.   The apparatus of claim 1, wherein the partially decoded data stream has variance, and wherein said data embedder is operable to reduce the variance of the partially decoded data stream.

6.   The apparatus of claim 5, wherein said data embedder is operable to:

sort the partially decoded data stream in at least one of ascending and descending order, thereby obtaining a sorted sequence;

construct a new partially decoded data stream by taking the difference of every pair of two consecutive samples in the sorted sequence while alternating the sign of every other difference value; and

substitute the new partially decoded audio data stream for the partially decoded audio data stream.

7.   The apparatus of claim 1, wherein said partial encoder and said partial decoder are operate via same codebooks.

8.   A decoding apparatus for extracting data embedded in a compressed data stream having embedded data, the apparatus comprising:

a partial decoder receptive of the compressed data stream and operable to partially decode the compressed data stream, thereby obtaining a partially decoded data stream having quantization indices; and

a correlation detector in communication with said partial decoder and operable to extract the data from the quantization indices.

9.   The apparatus of claim 8, wherein said correlation detector is receptive of a decoding key, and wherein said correlation detector is operable to extract the data from the quantization indices based on the decoding key.

10.   A method for embedding data in a compressed data stream, the method comprising:

receiving the data;

receiving the compressed data stream;

partially decoding the compressed data stream, thereby obtaining a partially decoded audio data stream having quantization indices;

embedding the data into the quantization indices, thereby obtaining a data-embedded partially decoded data stream; and

partially encoding the data-embedded partially decoded data stream, thereby obtaining a data-embedded compressed data stream.

11.   The method of claim 10 further comprising:

selecting a plurality of the quantization indices, thereby obtaining selected indices; and

determining respective amounts by which to modify the selected indices,

wherein said embedding the data into the quantization indices corresponds to modifying the selected indices according to the respective amounts.

12.   The method of claim 11, wherein said selecting comprises:

choosing indices corresponding to ranges within a sensitive portion

of a human sensory range; and

discarding zero indices.

13.   The method of claim 11, wherein said determining corresponds to

always determining a minimum amount.

14.   The method of claim 10 further comprising receiving an encoding

key, wherein said embedding the data includes modifying the selected indices

based on the encoding key.

15.   The method of claim 10, wherein the partially decoded data stream

has variance, the method further comprising reducing the variance of the partially

decoded data stream.

16. The method of claim 15, wherein said reducing comprises:

sorting the partially decoded data stream in at least one of ascending and descending order, thereby obtaining a sorted sequence;

constructing a new partially decoded data stream by taking the difference of every pair of two consecutive samples in the sorted sequence while alternating the sign of every other difference value; and

substituting the new partially decoded data stream for the partially decoded data stream.

17. The method of claim 10, wherein said partially encoding and said partially decoding are performed via same codebooks.

18. A method for extracting data embedded in a compressed data stream having embedded data, the method comprising:

receiving the compressed data stream;

partially decoding the compressed data stream, thereby obtaining a partially decoded data stream having quantization indices; and

extracting the embedded data from the quantization indices, thereby obtaining data.

19. The method of claim 18 further comprising receiving a decoding key, wherein said extracting is based on the decoding key.